Active Project (2016 - 2018)

Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD), Phase II Project

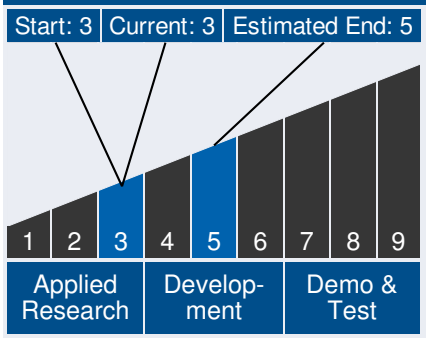
SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

NASA missions include long periods of low workload followed by sudden high-tempo operations, a pattern that can be detrimental to situational awareness and operational readiness. An unobtrusive system to measure, assess, and predict Astronaut cognitive workload can indicate when steps should be taken to augment cognitive readiness. This system can also support testing and engineering (T&E); engineers can accurately evaluate the cognitive demands of new tools and systems, as well as how they affect task performance. In our Phase I effort, Charles River Analytics designed and demonstrated a system for Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD). CAPT PICARD: (1) robustly and unobtrusively performs real-time synchronous data collection with a suite of sensors to provide a holistic assessment of the Astronaut; (2) extracts, fuses, and interprets the best combination of indicators of Astronaut state; (3) comprehensively predicts performance deficits, optimizing the likelihood of mission success; and (4) displays the data to support the information requirements of any user. The solicitation defined the following Phase I goals: review physiological, neurophysiological, and cognitive assessments in extreme environments and long duration missions; design an algorithm to assess workload. We did focus on these goals; however, we went beyond them to also demonstrate a functional prototype by the end of Phase I. Based on the success of this Phase I effort, we recommend a Phase II effort to refine and develop each component of CAPT PICARD, and iteratively evaluate this system in an undergraduate lab, at a T&E lab at Johnson Space Center (JSC), and in a mission-like analog environment at JSC. Successful completion of these tasks will result in a tool that can both dramatically improve Astronaut mission readiness and the design and development of tools Astronauts use to carry out mission objectives.

Table of Contents

Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Continued on following page.

Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD), Phase II Project

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: We expect the full-scope Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD) system to have immediate and tangible benefit for NASA. In particular, CAPT PICARD will help monitor the workload of Astronauts over short- and long-duration missions. We plan to enhance the effectiveness of widely-used tools, such as assessments that interrupt task performance, including the Psychomotor Vigilance Self-Test used by Astronauts on ISS missions (NASA, 2014) by incorporating the innovations developed under CAPT PICARD. Augmenting these tools will enable the crew monitoring Astronauts to cue Astronauts of impending deficits to augment mission performance. CAPT PICARD will also enable more effective testing and engineering by measuring the workload created by new tools and systems during design and development instead of during deployment. This capability will ultimately result in increased Astronaut performance and decreased cost to deploy technology to Astronauts, furthering NASA's goals of expanding the frontiers of knowledge, capability, and opportunity in space, and developing technologies to improve the quality of life on our home planet.

To the commercial space industry:

Potential Non-NASA Commercial Applications: We see two approaches to commercializing the technologies developed under this program. First, they can be licensed to other commercial entities that will use them directly or incorporate them as added functionality to their commercial products. In particular, long-haul trucking and shipping crew experience similar challenges as Astronauts' long periods of low workload. Therefore, we will look at companies in the long- and short-duration shipping market, including UPS and FedEx, as potential licensees of this technology. Second, we will incorporate this

Management Team *(cont.)*

Program Manager:
- Carlos Torrez

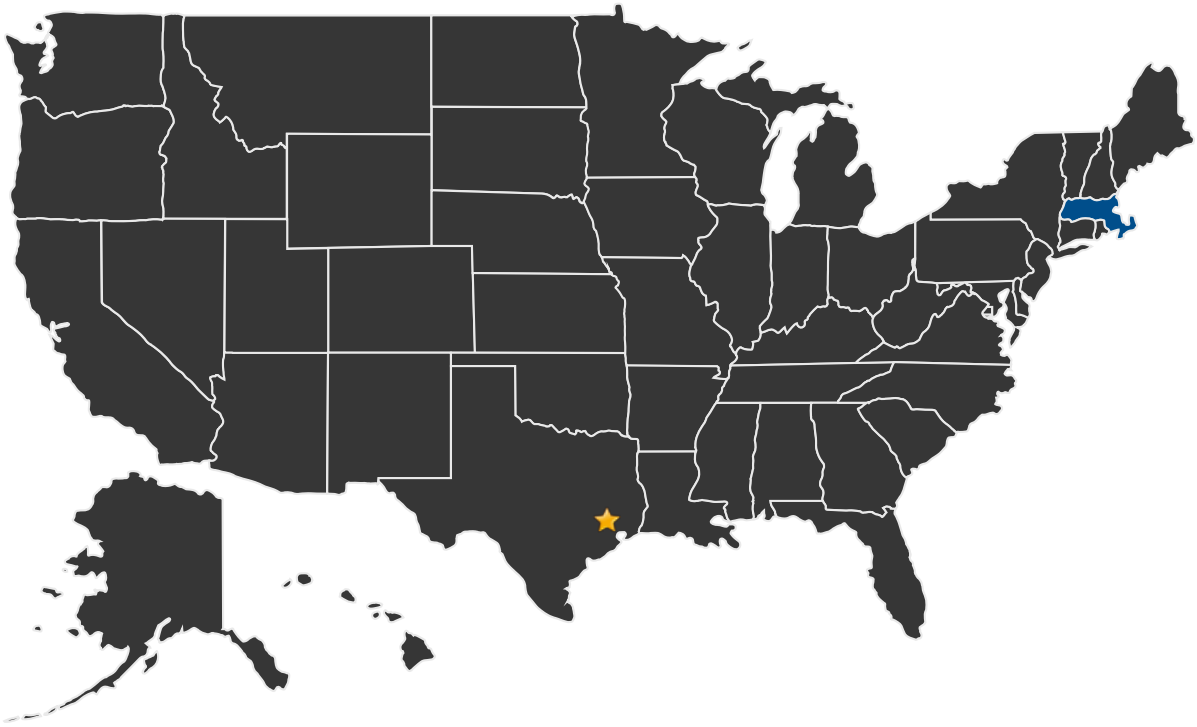
Principal Investigator:
- Bethany Bracken

Technology Areas

Primary Technology Area:
Human Health, Life Support, and Habitation Systems (TA 6)
└ Human Health and Performance (TA 6.3)
  └ Human Factors (TA 6.3.4)

new technology into our HumanSense? software, which will both increase its appeal as a commercial product and enable us to use the tool to provide consulting services based on HumanSense to customers within the DoD, other Federal agencies, and commercial markets.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Johnson Space Center

Other Organizations Performing Work:

- Charles River Analytics, Inc. (Cambridge, MA)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23437)

IMAGE GALLERY

Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD), Phase II

DETAILS FOR TECHNOLOGY 1

Technology Title

Cognitive Assessment and Prediction to Promote Individualized Capability Augmentation and Reduce Decrement (CAPT PICARD), Phase II

Potential Applications

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